



AFRL-RX-TY-TM-2008-4541

HYDREMA MINE AREA CLEARANCE EQUIPMENT VEHICLE VALIDATION LOAD APPROVAL

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FEBRUARY 2008

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DEPARTMENT OF THE AIR FORCE

HEADQUARTERS AERONAUTICAL SYSTEMS CENTER (AFMC)
WRIGHT-PATTERSON AIR FORCE BASE, OHIO

8 February 2008

MEMORANDUM FOR AFRL/RXQF
MR. MARSHALL DUTTON
104 RESEARCH ROAD, BLDG 9738
TYNDALL AFB FL 32403

FROM: ASC/ENFC (ATTLA)
2530 Loop Road West
Wright-Patterson AFB OH 45433-7101

SUBJECT: Hydrema Mine Area Clearance Equipment Vehicle Validation Load Approval

CAUTION: Sleeper shoring validation may be performed in a controlled environment by AFRL/RXQF personnel at a later date. If done separately from aircraft validation, hydraulic pressure shall not be interrupted during load/off-load operations or while item is on aircraft. Request primary loadmaster validate pressurization & depressurization of hydraulic system off aircraft to verify procedures in this memo and attachment 1.

1. The Hydrema Mine Flail System is a two axle, heavy equipment, armored vehicle designed to clear transportation routes of mines, IED and UXO type devices. Vehicle dimensions are 361" L X 109.5" W X 106.5" H. Approximate Gross Vehicle Weight (GVW), front and rear axle weights are 36,100 lbs, 18,000 lbs and 18,100 lbs respectively. Front and rear axle ratings are 61,000 lbs each. When the subject item is loaded aboard C-130 aircraft, it will be equipped with an additional hydraulic single axle on the front end and a tandem bogey axle set on the aft end of the vehicle. Dimensions when configured for C-130 transport are approximately 412" L X 98.5" W X 106.5" H. Vehicle cabin height is approximately 99 inches. Approximate gross vehicle weight, front hydraulic axle, front main axle, rear main axle, aft lead bogey axle and trailing bogie axle weights on a horizontal surface are 37,422 lbs, 7,365 lbs, 10,585 lbs, 5,955 lbs, 6,981 lbs and 6,536 lbs respectively.

2. Based on dimensions and structural information (axle ratings, tiedown ratings, etc), provided by Hydrema, TARDEC and AFRL/RXQF the subject item is approved for validation loading operations on USAF C-5A/B/C, C-17A and C-130 E/H aircraft with the following provisions:

- a. C-130: Flail system shall be stowed in the displaced position to reduce overall width less than or equal to 99 inches.
- b. C-130: Maximum air transport weight is 38,250 lbs. Individual axle weights shall not exceed 13,000 lbs when loading/loaded on C-130 aircraft. Do not exceed compartment flight/loading limitations.
- c. C-5/C-17: Maximum air transport weight, front and rear main axle weights shall not exceed 40,000 lbs, 20,000 lbs and 20,000 lbs respectively.

d. Preparation:

- 1) See Attachment 1 for instructions in assembly of tandem axles for C-130 transport. Confirm shipper has properly assembled tandem axles and hydraulic system prior to load time.
- 2) Shipper is responsible for providing sleeper shoring.
- 3) Fuel level in each tank should be approximately $\frac{1}{4}$ full.
- 4) Chains and hammers will be removed from the flail rotor.
- 5) Water reservoirs shall be empty.
- 6) Shield and flail frame will be secured individually.

e. Tire inflation pressure shall not exceed 100 PSI.

f. Loading Procedures:

- 1) Normal TO 1C-XXX-9 vehicle load/off-load procedures shall be used in conjunction with additional procedures in this memo.
- 2) When item is loaded on C-5/C-17 aircraft without C-130 tandem axle configuration installed, only normal load/off-load operations apply. Sleeper shoring is required.
- 3) C-130: Item will be loaded driven on front end facing forward in aircraft.
- 4) C-5/C-17: Item may be loaded driven or backed on aircraft. When item is configured with C-130 tandem axles, vehicle will be driven on aircraft with front end facing ramp used for loading. It is permissible to load item with tandem axles fully raised to permit steering when tandem axle wheels are not in contact with ground or aircraft floor surfaces.
- 5) Position vehicle in front of ramp used for loading operations and ensure vehicle and wheels are as straight as possible. When item is configured with C-130 tandem axles, and axles are deployed (supporting vehicle weight) it is not capable of steering.
- 6) C-130: Deploy wheel sets. Hydraulic pressure on the front axle shall be 150 bar/2,176 psi and 154 bar/2,234 psi on the rear axle set. Pressure tolerance is +/- 2 bar or 28 psi.
- 7) Hydraulic pressure shall not be interrupted until vehicle is sleeper shored.
- 8) Manufacturer recommends driving as slow as possible (less than 1 mph) during load/off load operations when vehicle is configured with C-130 tandem axles.
- 9) Load item aboard aircraft in lowest gear while regulating speed using foot brake. There should be approximately 2 inches clearance between the top of the cab and the aircraft ceiling structure during the most critical projection point while loading.
Note: C-130 E/H start station is FS 291.
- 10) Once vehicle is in final position for flight, activate the parking brake, keep engine at idle and hydraulic system pressurized until sleeper shoring is installed. **Caution:** Ventilate aircraft.
- 11) Eight stacks of sleeper shoring required. Minimum base dimensions are 10" L X 10" W (4 pieces) for front and aft ends. Minimum base dimensions are 15" L X 10" W (4 pieces) for use between main axles. **Caution:** *Sleeper shoring will be installed before hydraulic pressure is relieved from vehicles configured with tandem axles.* Sleeper shoring will be stacked snug under frame locations and shall be secured with cargo straps. See Attach 2 for pictorial representation of sleeper shoring stack locations and additional shoring dimension information.
- 12) When all sleeper shoring stacks are installed snug under frame and designated locations, relieve hydraulic pressure from the tandem axles. This is accomplished by slowly raising the wheel sets until the first set of wheels leaves the floor. Once first set of wheels is raised off the floor, the engine may be shut down.

d. Preparation:

- 1) See Attachment 1 for instructions in assembly of tandem axles for C-130 transport. Confirm shipper has properly assembled tandem axles and hydraulic system prior to load time.
- 2) Shipper is responsible for providing sleeper shoring.
- 3) Fuel level in each tank should be approximately $\frac{1}{4}$ full.
- 4) Chains and hammers will be removed from the flail rotor.
- 5) Water reservoirs shall be empty.
- 6) Shield and flail frame will be secured individually.

e. Tire inflation pressure shall not exceed 100 PSI.

f. Loading Procedures:

- 1) Normal TO 1C-XXX-9 vehicle load/off-load procedures shall be used in conjunction with additional procedures in this memo.
- 2) When item is loaded on C-5/C-17 aircraft without C-130 tandem axle configuration installed, only normal load/off-load operations apply. Sleeper shoring is required.
- 3) C-130: Item will be loaded driven on front end facing forward in aircraft.
- 4) C-5/C-17: Item may be loaded driven or backed on aircraft. When item is configured with C-130 tandem axles, vehicle will be driven on aircraft with front end facing ramp used for loading. It is permissible to load item with tandem axles fully raised to permit steering when tandem axle wheels are not in contact with ground or aircraft floor surfaces.
- 5) Position vehicle in front of ramp used for loading operations and ensure vehicle and wheels are as straight as possible. When item is configured with C-130 tandem axles, and axles are deployed (supporting vehicle weight) it is not capable of steering.
- 6) C-130: Deploy wheel sets. Hydraulic pressure on the front axle shall be 150 bar/2,176 psi and 154 bar/2,234 psi on the rear axle set. Pressure tolerance is +/- 2 bar or 28 psi.
- 7) Hydraulic pressure shall not be interrupted until vehicle is sleeper shored.
- 8) Manufacturer recommends driving as slow as possible (less than 1 mph) during load/off load operations when vehicle is configured with C-130 tandem axles.
- 9) Load item aboard aircraft in lowest gear while regulating speed using foot brake. There should be approximately 2 inches clearance between the top of the cab and the aircraft ceiling structure during the most critical projection point while loading.
Note: C-130 E/H start station is FS 291.
- 10) Once vehicle is in final position for flight, activate the parking brake, keep engine at idle and hydraulic system pressurized until sleeper shoring is installed. **Caution:** Ventilate aircraft.
- 11) Eight stacks of sleeper shoring required. Minimum base dimensions are 10" L X 10" W (4 pieces) for front and aft ends. Minimum base dimensions are 15" L X 10" W (4 pieces) for use between main axles. **Caution:** *Sleeper shoring will be installed before hydraulic pressure is relieved from vehicles configured with tandem axles.* Sleeper shoring will be stacked snug under frame locations and shall be secured with cargo straps. See Attach 2 for pictorial representation of sleeper shoring stack locations and additional shoring dimension information.
- 12) When all sleeper shoring stacks are installed snug under frame and designated locations, relieve hydraulic pressure from the tandem axles. This is accomplished by slowly raising the wheel sets until the first set of wheels leaves the floor. Once first set of wheels is raised off the floor, the engine may be shut down.

13) Restrain vehicle for transport IAW paragraph 3.

g. Off-Load Procedures:

- 1) Normal TO 1C-XXX-9 vehicle load/off-load procedures shall be used in conjunction with additional procedures in this memo. When off-loading from C-5/C-17 aircraft without C-130 tandem axle configuration installed, normal load/off-load operations apply.
- 2) Remove restraint.
- 3) C-130: Deploy wheel sets. Hydraulic pressure on the front axle shall be 150 bar/2,176 psi and 154 bar/2,234 psi on the rear axle set. Pressure tolerance is +/- 2 bar or 28 psi.
- 4) Hydraulic pressure shall not be interrupted once required pressure is obtained.
- 5) Remove sleeper shoring.
- 6) Manufacturer recommends driving as slow as possible (less than 1 mph) during load/off load operations when vehicle is configured with C-130 tandem axles.
- 7) Position observers to monitor critical clearances.
- 8) Off-load vehicle in lowest gear while regulating speed using foot brake.

3. The Hydrema Mine Clearance Vehicle and all accompanying cargo must be restrained to meet MIL-HDBK-1791 requirements of 3G forward, 1.5G aft and lateral, and 2G up. In addition, stored or installed equipment must meet these requirements and be capable of withstanding a 4.5G down load. Provision locations and rated capacities are listed in Table 1.

Table 1: Provision Location & Rated Capacities

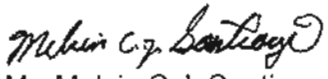
Provision Location	Longitudinal	Lateral	Vertical
Front Provisions (vertical bars under winch)	15,000 lbs	30,000 lbs	6,000 lbs
Front Main Axle	35,000 lbs	35,000 lbs	50,000 lbs
Aft Main Axle	35,000 lbs	35,000 lbs	50,000 lbs
Aft Tow Bar	30,000 lbs	20,000 lbs	8,000 lbs

4. All hazardous materials (to include fuel level, batteries, etc.) must be prepared and certified for airlift in accordance with TM 38-250/AFMAN 24-204(I). Do not consider this air transport certification as approval for hazardous materials. Authorization for airlifting hazardous material is the responsibility of HQ AFMC LSO/LOT (DSN 787.4503 or COM (937) 257.4503). The servicing Air Terminal Operations Center (ATOC) can assist you in this regard.

5. This validation load is required to verify loading, restraint & hydraulic system procedures for the subject item. The primary loadmaster is requested to note back to the Aerial Delivery (ATTLA) POC in paragraph 8 with any potential errors and recommended enhancements to these procedures.

6. Shipper shall give a copy of this memo to the ATOC representative when the item is presented for validation load. This memo shall be presented to the aircraft loadmaster prior to loading this item.

7. This memo was prepared by MSgt Doug Simpson. For certification issues or questions regarding this project, contact Douglas.Simpson@wpafb.af.mil, DSN 785.2547 or COM (937) 255.2547. Refer to file number 2004.06.03 to reference this memo.


Reviewed by: Mr. Melvin C.J. Santiago
Aerial Delivery Technical Expert
Crew Systems Branch


Approved by: Mr. John C. Hill
Acting Technical Advisor
Crew Systems Branch

2 Attachments:

1. Bogie Wheel Installation Instructions
2. Sleeper Shoring Placement Locations

cc:
HQ AMC/A3V
SDDCTEA
Hydrema

Attachment 1: Bogie Wheel Installation Instructions

Mounting of C-130 Axle Set

The axle set for driving onto a C130 transport aircraft consists of two parts: a single axle for mounting in front of the cab and a tandem axle for mounting behind the machine's rear axle.

The set can be fitted by 2 men without the use of special tools.



The front single axle set consists of:

- 1 x cross member
- 2 x mounting shafts
- 2 x nuts M30
- 2 x brackets part-assembled with cylinders
- 2 x insertion shafts
- 4 x ring split pins
- 1 x wheel axle with hub
- 2 x wheels
- 2 x screws M16
- 2 x mounting washers



The rear tandem axle set consists of:

- 2 x brackets part-assembled with cylinders
- 2 x mounting shafts
- 2 x ring split pins
- 1 x wheel axle
- 2 x tandem axle sets with wheels
- 4 x screws M16
- 4 x mounting washers



Mounting of single axle set:

Cross member

Fit the cross member up under the drawbar eyes beneath the winch.

The 2 mounting shafts with nuts are fitted from below.



The brackets are part-assembled with hydraulic cylinders, hoses, etc.
The bracket which is fitted with a hydraulic pressure control valve and pressure gauge is located on the left side of the machine.

Lift the brackets up to the cross member between the forks. For support they can be placed on the levers above the forks.

The brackets can then be lifted the remaining distance such that the notch fits up against the cross member. The insertion shafts for the bracket should be fitted with ring split pins.

Screw out the support screws such that they just touch the front wall of the cab.

Mount the wheels on the wheel axle and the wheel axle on the end of the arms with the stub axles foremost.

Lock the wheel axle with screws and washers.

Mounting of tandem axle set:

Place the part-assembled brackets behind the rear chassis.

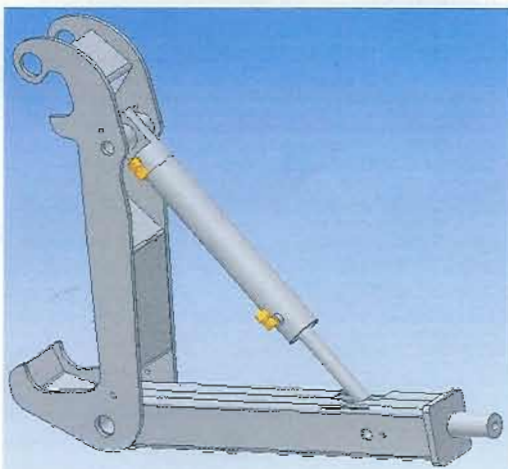
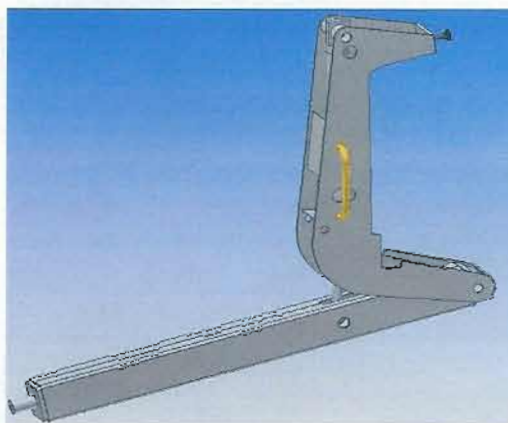
The bracket which is fitted with hoses is located on the left side of the machine.

Lift the brackets vertically and hitch them onto the axle between the chassis sections. The mounting shafts and ring split pins can then be fitted by lifting the brackets the remaining distance.

Mount the transverse bar on the end of the arms with the stub axles rearmost.

Lock the transverse bar with screws and washers.

Fit and lock the tandem axles with screws and washers.



To reduce the movement of the cabin, a distance must be fitted between cabin and main frame.

Fit the hooks with tape at the frame as high as possible and adjust the support screw 4-5mm from the cabin wall (when wheels are unloaded)

Hydraulic connections:

The hoses can now be fitted.

All hose ends are color-coded with strips.

Fit the 2 short hoses with quick hitch fittings in the quick hitch fittings where the winch is normally connected.

Fit the two slightly longer hoses to the cylinder on the right bracket.

Fit the 2 very long hoses to the hydraulic block on the front left bracket.

Fit the other end onto the cylinder on the left rear bracket.

The hose ends on the left cylinder should be fitted on the right according to the color codes.

The wheel sets are now ready for a function test.

Start the engine – let it idle.

Activate the control lever for the winch (see operator's manual, page 27-15) and check that both sets of wheels move up and down.

When the wheels are exerting pressure downwards, check the pressure on the pressure gauges. The pressure on the front set of wheels must be 150 bar/ 2176 psi and 154 bar/ 2234 psi on the rear set of wheels.

If the pressure is not within +/- 2 bar, the pressure reduction valve can be adjusted.

The machine can be driven normally when the sets of wheels are raised. However, the operator should make sure that the hoses can reach from front to rear, and that they do not get trapped when steering the vehicle.



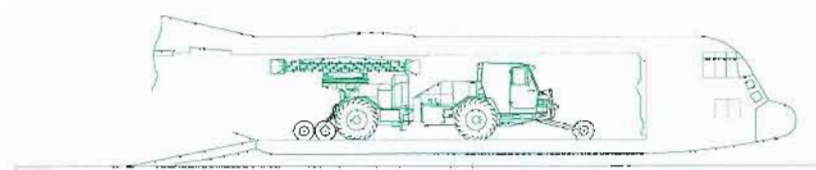
Driving onboard:

Prior to driving onboard:

Pay attention to the fact that the vehicle must not be steered when driving onboard and that the hydraulic pressure must not be interrupted before the machine is sleeper shored in the aircraft. Drive at a constant slow speed – corresponding to 110 yards/hour. Ensure that a loadmaster is positioned to direct the driver.

1. Position the machine a few yards from the C130's ramp. Make sure that the machine is positioned as straight as possible and steers as straight ahead as possible.
2. Lower the sets of wheels and keep the control lever constantly activated.
3. Drive the machine slowly up the ramp by putting the gear selector into 1st gear and accelerating as necessary. Regulate speed using the footbrake.
4. When the machine is correctly positioned, activate the parking brake. Keep the engine idling with the hydraulics still activated.
5. The hydraulic pressure may not be released until the shoring stacks have been put into place and are snug against chassis structures. This is done by slowly beginning to raise the sets of wheels until the first set of wheels has just left the floor, and the engine can then be stopped.
6. The machine must then be secured by the tie down procedure.

To exit the aircraft carry out the above procedure in reverse.



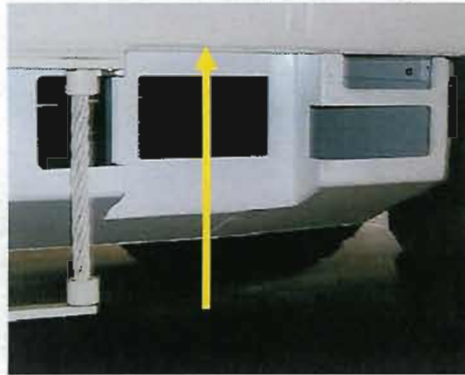
Attachment 2: Sleeper Shoring Placement Locations

Side View



Note: There are two stacks at each location, one each side.

Front & Aft End Sleeper Shoring Placement



Front end shoring will be positioned in cut out location aft of cab access ladder. Cut out dimension is 11" L X 5" W. Top dimension of shoring will be 10" L X 4.5" W. Shoring base dimension will be minimum 10" L X 10" W. Recommend base length of 15"



Aft end shoring stacks will be positioned under plates. Plate dimensions are 7" L X 6" W. Top dimension of shoring will be the same as the plate. Shoring base dimension will be minimum 10" L X 10" W.